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THE STRATEGIC DEFENSE INITIATIVE*

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I am a supporter of and an advocate for the Strategic Defense Initiative (SDI). I think that the program is based on weapons concepts which are technically achievable, and that those concepts, if properly implemented, will radically alter the character of warfare and redefine the determinants of military power. Those weapons will, in my opinion, contribute in a major way to the security of the United States and our allies and will greatly reduce the likelihood of a global nuclear war. I think these results can be attained with ideas pretty much in hand today and that new ideas, which are emerging rapidly from the intellectual ferment of the SDI, will amplify, maybe greatly amplify, those results. In the text following I will explain why I have reached these conclusions--why I hold these opinions.

Over the past eighteen months most of the discussions of the SDI have focused on the technical achievability of defenses capable of enforcing total or near total damage denial in the context of a strategic missile attack on the U.S. by the Soviet Union. Damage denial is an interesting subject. It is a lot of fun for analysts with quick minds for the "what-ifs" and the "yes-buts" and with sharp pencils to back up their speculations. But in any real sense the debate about leak-proof defenses faced with responsive threats is not resolvable. Nor, do I think, is it a very useful debate. Let us back away from these sharp penciled absolutes and look at what we might, with some confidence, expect that the SDI would accomplish, and see if that is worthwhile.

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First, I will describe what I think is a reasonable, technically achievable, defensive system, and then I will address what it might do for us.

Since I am not a spokesman for the SDI Program, I am not obliged to maintain an impartial position with respect to all of the various weapon candidates. Accordingly, I will emphasize laser weapons and rocket propelled interceptors in my comments--laser weapons because they, alone of the candidates, are capable of operating into the atmosphere. I think this is a critical factor. It opens up the broad range of tactical missions, which have been left out of the picture in structuring the SDI. Also, it is the one technology which permits the defensive weapons to fire back if attacked from within the atmosphere, and it is the one technology which can grow to cope with fast burn missile boosters that might be expected as at least one Soviet response. I think these capabilities are compelling! Rocket propelled interceptors are included because they are particularly effective for defending the space assets against attack by heavily armored close-approach weapons and are very lethal in any space combat role where the time lines are not stressing and the targets are not actively defended.

The laser weapons could have a radiant intensity of 3×10^{20} watts per steradian and be deployed in a constellation of 50-100 battle stations. This is the standard mark one, mod zero SDI laser weapon concept that has received so much critical attention. It does not postulate the factor of 30-100 improvement in radiant intensity that is

the focus of the inventive juices of the SDI today and which may or may not be realized in time to be implemented in the initial deployment. I will, however, postulate the following important upgrades to the standard concept. First, each battle station carries consumables sufficient for thousands, instead of hundreds of seconds of operation. Second, they are equipped with sensors suitable for engaging tactical as well as strategic targets. Third, they carry maneuver fuel for about 1 km/sec delta V--roughly a 40% added weight penalty. Fourth, they each carry a large number, one hundred to several hundred, of small rocket propelled interceptors; and fifth, the battle stations are armored with between 10-40 g/cm² of metal or composite armor. Collectively, these added features will increase the mass of the battle stations by a factor of 5-10, bringing it to between 500-1000 metric tons. This may appear, at first glance, to be radical, but the added mass is almost all in the form of low technology elements--armor and fuels. The cost impact of this will be mostly launch costs and will increase the price of the battle stations by something in the range of several tens to one hundred percent. It will be an investment with very high leverage.

These battle stations would be very difficult to destroy. Close-approach weapons including direct ascent nuclear weapons, upgrades of the current Soviet ASAT, pellet clouds, and Soviet versions of the U.S. minivehicle interceptor--could all be countered in large numbers by the combination of armor, evasion, and the defensive firepower of the lasers and the rocket propelled interceptors. Directed energy weapons would also be hard pressed to destroy such armored targets, unless the attack

were mounted by a force of considerable superiority in numbers or in technology. Now, I want to flag this point for emphasis--with a suitable and affordable investment in mass, these space weapons can be made highly survivable. In the star wars debate, much has been made of the triviality of killing space systems. This is an erroneous picture that derives from the historical fact that satellite technology, at least U.S. satellite technology, has been a marvel of mass-frugal design. The traditional mindset of our satellite designers has been to make every gram count, and their products have been defenseless and tissue paper soft. Strategic defenses will not emerge from this mindset. Armored vehicles, not satellites, are the paradigm to build on. It is a feasible and affordable paradigm in the context of space combat and space weapons.

Even with heavy armor the vulnerabilities of sensors and optics, particularly large optics, must be acknowledged. Various techniques exist which will make these components much harder than we know them to be today; but nevertheless, if attacked by directed energy weapons, specifically and particularly directed energy weapons employing an impulse mode of attack, sensors and optics will remain the softest part of the battle stations. Their survivability rests primarily on restricting access to them by hostile impulse weapons--through field-of-view restrictions and by shuttering when they come into peril. These two factors will enormously complicate an enemy's efforts to exploit the comparative softness of sensors and optics.

This is not a picture of invulnerable space weapons, but these weapons are very rugged, very tough. They can be destroyed, possibly,

but only with difficulty and only with saturation tactics combined with advanced technology. And they can probably be suppressed, that is forced to avert or to button up, but only transiently and only by exotic tactics combined with advanced weapons. It is likely, I think, that the Soviets will undertake to develop the capability to accomplish these objectives--destruction and suppression of the defensive systems. But that is certain to be a daunting problem for the Soviet technologists. And whatever they accomplish towards those ends, the difficulty of the task is certain to leave large and inhibiting uncertainties in the minds of Soviet attack planners, who will demand a comfortable and confident combat advantage before placing at risk their Nation's strategic forces, and, indeed, their Nation itself. And we have not yet laid on the table those large upgrades in laser weapon performance which are a possibility even before the first deployment and which are likely as an eventuality.

Let us look next at what capabilities this constellation of weapons would have. We will address this for both tactical and strategic roles.

In tactical combat the constellation would be capable of covering every point on Earth, down to the surface or to the tops of clouds if clouds are present, continuously, and with multiple overlapping fields of fire at a delivery level of several to more than 10 kW/cm^2 . This delivery level would be highly lethal to all objects not heavily armored, buried, or hidden. Aircraft, cruise missiles, air defenses, logistic supplies in transport, and even the top side combat systems of naval vessels would be broadly accessible and highly vulnerable to attack.

With the expanded magazine postulated for these weapons, each would be carrying about a thousand engagements, for a total deployed combat depth of 50,000-100,000 engagements. With the singular exception of guerrilla warfare, this would constitute a pervasive, dominant factor in every form of tactical combat. It would be capable of intervening at will in any action not protected by clouds--of the selective and surgical destruction of critical assets. Unlike nuclear weapons, which are too horrible to use or to threaten to use, in those lower level wars which plague our planet, these weapons would have a usability and a credibility of use which could significantly inhibit aggressive behavior. Or, they could support aggressive behavior, if that were appropriate. Such a force would be a compelling new factor in the international equations of power. It would deeply compromise the growing Soviet superiority in conventional arms, vital elements of which are the extremely vulnerable aircraft and helicopter assets. The Soviets could not ignore it. They would be forced into a long and difficult technical race with the U.S. in order to recapture that superiority of arms which they presently enjoy, which they have purchased at such sacrifice over the past forty years--that intimidating superiority of arms which underlies the bullying tactics of Soviet foreign policy.

Let us look next at strategic war. I have already commented on the possibilities that the Soviets could destroy or suppress a first generation defensive constellation. I have also made the point that those are difficult goals to reach, that a combination of high technology and saturation levels of attack are required, and that, even given those

elements, a large uncertainty would exist in the minds of the Soviet leaders regarding the outcome. An additional Soviet response might be to upgrade their missile forces to achieve much higher levels of saturation--to penetrate the defenses through sheer numbers and short time lines. This could be effective against a first generation system, such as I am addressing here. The elements of enhanced penetration are the fast boosters together with deMIRVing and fast decoy deployment. All of these elements are required. Fast boosting alone yields only a factor of four or so in the engagement rate, and that is an insufficient margin. DeMIRVing multiplies that by yet another factor of 8-10, and together the margin is compelling. At least it is compelling against the laser weapons I am talking about. The 30 to 100-fold improvement in laser radiant intensity which the SDI is busy inventing is sized to defeat exactly those responses. But let us leave those improvements off the table and see what we have accomplished even if they do not materialize.

The most notable thing we have accomplished is the suppression of all of the backdoors to World War Three--control over that broad range of scenarios in which global war emerges unintended from miscalculation and escalation. The defensive constellation is a dominant force that can prevent the use of ballistic missiles in any circumstance short of a committed massive attack by the Soviets, a massive attack employing technology well in advance of that which is presently deployed. This is a major accomplishment, since the paths of miscalculation and escalation constitute, in fact, the major peril of catastrophic war.

We have also realized a major improvement in crisis stability. Motivating the Soviet ICBM forces away from the heavily MIRVed SS-18s and into deMIRVed singlets gives those forces confident survivability against any imagined or feared U.S. preemptive nuclear attack. The psychology of "use it or lose it" is cancelled; in fact, the reverse situation obtains--the Soviet strategic forces come into danger only if they are used. The U.S. ICBM forces are also more secure--even if we have not had the good sense to deMIRV and disperse our missiles. The Soviet first strike has been deflected from the U.S. missile fields to the assets in space. The dilemma of when to launch is relaxed.

Thirdly, we have realized a major inhibition to the front door to World War Three--war by calculated intent. Large uncertainties have been introduced into the combat exchange calculations; the Soviets cannot expect to catch our missile or bomber forces on the ground after they have initiated a massive attack in space; and unless the Soviets can be confident of destroying, not just suppressing or saturating, our space defenses, they will not be able to count on their bomber forces or their submarine forces to support the attack; the feasibility of Soviet follow-through attacks will be compromised, and the U.S. defenses would be positioned to suppress Soviet ABM systems in support of a U.S. responsive attack. These factors will greatly reduce the attraction of a pre-meditated attack.

When I look at these things that the SDI could probably accomplish, I am mightily impressed. In fact, it seems that the SDI, even without the

upgrades we are inventing, will accomplish just about everything--except that goal of confident damage denial which has been identified as the singular reason for the program.

Of course, the Soviets will move in this direction also. They will really have no choice but to race us for supremacy in space. I welcome that contest, although I do not expect it to be an easy one. When we get to space with our weapons, I do not think we will be alone for very long. And we might not be first. But I look for this to be a very long race before one side or the other could achieve that confident margin of superiority which would support aggressive confrontation. Between now and then there is room for a lot of history to occur. In the course of this race I expect that the role of nuclear weapons will gradually change. Today, at the beginning of the race, nuclear weapons are the primary means of fighting a war, and incidentally of destroying nations in the process. Fifty years from now, when this new era is well advanced, I expect that space weapons will be the primary means of fighting a war, and nuclear weapons will be for intimidating the loser into a properly humble and cooperative posture.

So, these are the reasons that I support the Strategic Defense Initiative. I find them compelling. Even without invoking the theology of damage denial!